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ABSTRACT

The evolution of creative thought was examined, an examination that resulted in the construction of universal criteria for analysis and detailed evidence for the evolution of novelty, i.e. how children create knowledge. The collected data came from 200 students from the United States and 200 from Brazil. Each of the 10 age groups (from 4 to 13 years old) consisted of 40 subjects. Students, who were selected based on their involvement in a problem-solving musical activity that led them to the construction of a story, were studied individually in sessions that lasted no longer than 45 minutes per child. Deductive analysis of the interviews showed how various observable responses were interwoven. Cuts were made based on the descriptions of movements noticed, and these cuts resulted in three possible distinct levels or phases, defined as Initial (Level 1), Intermediate or Transitional (Level 2), and Final (Level 3). From this phase analysis, the characteristics that defined creative functioning were identified. In both cultures there were fundamental mechanisms that led to the production of novel ideas in the logical problem-solving process. Creativity was studied concretely, and defined as the evolution of creative thought itself. This evolution provided evidence for equilibrium occurring in the problem-solving process. Phase criteria were universal and independent of cultural interference, and results show that the subjects' behavior is not structured by the environment, but by the subjects themselves. (Contains 15 references.) (SLD)

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Opening of Schemes and the Expression of Knowledge Structures in the Construction of Novelty: A Developmental Study of Brazilian and American Children

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Abstract

In this study, we examined the evolution of the creative thought. This examination resulted in the construction of universal criteria for analysis and detailed evidence for the evolution of novelty, i.e., how children create knowledge. Two different cultures, United States and Brazil, were observed and analyzed. The collected data consisted of 400 subjects, 200 for United States and 200 for Brazil. Each of the 10 age groups (from 4 to 13 years old) consisted of 40 subjects. Subjects were studied individually in sessions that lasted no longer than 45 minutes per child. The subjects were selected based on their involvement in a problem-solving musical activity which led them to the construction of a story. Using deduction we analyzed the interviews while we observed what was occurring, to learn how the various observable responses were interwoven. We proceeded to the description of the movements noticed and made the cuts that these movements permitted. These cuts led us to three possible distinct levels or phases, called since then Level I, II, and III, and defined as Initial, Intermediate and/or Transitional, and Final. From this phase analysis we were able to observe the characteristics that defined creative functioning. This analysis showed that in both cultures there were fundamental mechanisms which led to the production of novel ideas in the logical problem-solving process. Creativity was studied concretely and defined as the evolution of creative thought itself. This evolution provided evidence for equilibration occurring in the problem-solving process. To create was equivalent to the practice of creation. When the subject is creating a thought, he or she also learns how to think (creates and exercises the opening of schemes, maintains previous schemes, and creates new structures), demonstrating in this manner one of the facets of the construction of intelligence. The

phase criteria were universal and independent of cultural interference and the results showed that the subject's behavior are not structured by the environment, but by the subjects themselves.

Opening of Schemes and the Expression of Knowledge Structures in the Construction of Novelty: A Developmental Study of Brazilian and American Children

There has been a wide variety of creativity studies. For example, there have been studies on creativity (Csikszentmihalyi, M., 1988), creative activity in a developmental perspective (Gardner, H., 1994), the creative process (Feinberg, S., 1994; Figueiredo, E. L., & Machado, F. S., 1994) , creative products (Davidson, L., 1990), accessing and assessing creativity (Feldhusen, F. & Gohn, 1996), training creativity (Torrance, E. P., 1995), testing creativity (Cooper, E., 1991), creativity as a long life production, as recognized by society, (Csikszentmihalyi, M., 1996), etc. Our work is an additional attempt to understand creativity, but with a different focus. We study the emergence of creativity from a developmental perspective. We want to understand how children create or construct novel ideas about their world. We hypothesize that it is possible to observe the opening of schemes and the construction of structures. This research concerning the emergence of structures in one domain should help us to understand how structures emerge in other domains.

Based on Piaget's verbal logic (Piaget, J.,1972), we have a basic and, for now, a sufficient theoretical support to assign children's creative thinking to different sublevels. These annotated sublevels allow us to observe and compile evidence concerning the observable elements and characteristics of the movements (phases) manifested by each subject when creating solutions for proposed problems. It is possible to note an analogy of Piagetian stages and the creative levels of problem solving. It is our intention to verify this analogy but without using approximate age groupings as Piaget did (Piaget, J., 1985). We plain to observe and document

children's capacity for creation, independent of chronological age, using the criteria of problem solving levels. The results should enable us to analyze how the evolution of the creative thought occurs. This is our distinctive contribution, since there is no evidence of studies of this sort in the literate.

The verbal logic (Piaget, 1972) and the analogy of the possibility, with the levels (Piaget, 1985), will provide us with the localization of subjects in the universe of the analysis and the final analysis consequently would deal with the annotation of the occurred openings, with the provided possibilities, with the disequilibria, with successive equilibrations and with progressions.

It is hypothesized that the barriers explained by the verbal logic are the pseudo necessities or pseudo impossibilities; they could be all occurring together in the same action or even in the absence of the subject action. They could consist of what is real and actual for the subject at the right moment of the problem solution. These observations could be used to analyze the movements and they also could explain how the schemes change, amplify, open, and how the structures are progressively formed. Using a more general view, we could see subjects performing their own evolution in different levels. By using a progressive view, we could see the movements occurring once each sublevel contains successive equilibrations that leads the subject from one level to the next higher level.

When we started the analysis of a pilot project, we observed that it was possible to do a comparison between a certain level and the preceding one. For what we have seem since we started to question the existence of the evolution of the creative thought, the examples observed in one level could have been founding the possibilities of the other level theoretically defended. The observable changes needed to be relied by the theories and/or suppositions available in the

current literature. Certainly we were expecting that the two things would happen and this relationship would be sufficient to elucidate when one level showed the implications in it to be concreted in the posterior level. At the same time, we could be looking for what was occurring at and coming from the preceding level, aspects that would show us the existence of the Evolution of the Creative Thought.

The concreteness of our assumptions will enable us to observe the concepts that Piaget presented us on anticipation, on conservation, and on the open system (brace system). These concepts provide us the anticipation throughout the possibility of the application or transference of a schema to a new situation before two extensions: one forward and the other backwards, each one of them being sufficient because they can be decomposed in extrapolations and in recurrences while are being schematized (Piaget, J., 1973). If our subjects know by extrapolating, they will be observed on the act of creating; if they evoke or extend there will be showing they never will be damage because they will be maintaining the initial knowledge. There, we will evidence that there is no loss in the act of thinking creatively in the solution of problems.

We propose that the act of thinking results in the maintenance and/or in the production of novelties. It is known that the openings of possibilities can not be observed with the same subject or based upon a single subject; instead, it could be observed in the epistemologic subject (the motions and/or movements occurred between levels and sublevels). It is as if observing the motions an/or movements of all subjects, we were also observing a unique one - the one in evolution (Piaget, J., 1978). Being that, through the evolution of the creative thinking of a great number of subjects, we can arrive at the evidence of the evolutive thinking of a single one - the epistemic.

Method

The Experiment

The experiment had four phases, conducted as interviews: each child participated in an oral activity of idea production, oral production of a story, expansion of the story, and production of a title for the story. Subsequently, we developed three procedures to look at the data, through deduction, from the observation of the elements given, in order to elaborate a criteria which would provide an instrument for the analysis of the data.

First Phase

The subjects are invited to participate in an oral activity of idea production. We tell them that in order to have lots of ideas we play a lively piano music. While listening them can get all the ideas that they can possibly think of. The more, the better. We inform them that when getting ideas by listening to the music they are certainly allowed to request to have the tape paused any time. That is, so we could have time to write down a list of all the ideas they might come up with. Even after the music ends and they generated many ideas from it, the subjects are still encouraged to give out more ideas. They are asked if they want to listen again to get more ideas. Every single idea is accepted and the last ideas are always added to the first ones. We use the term ideas attempting not to direct and conduct the subjects production, because if we literally ask for words, the subjects could feel constrained. If they start to think in terms of ideas, they could give out words or short phrases about what they are having in mind as their immediate thoughts.

Second Phase

After a phase of musical listening and producing a list of ideas, the subjects are asked to tell us a story which will be annotated (recorded) in its full length. To tell the story they can rely

on the list made previously, keeping the presentation of ideas in the same initial order so that the same sequence is kept. They are allowed to consult the list as much as needed.

Third Phase

At the conclusion of the two first phases (consisting of the listening to music , producing a list of ideas and a story), the subjects are invited to continue as long as they can. They are also encouraged to expand the contents of the story. In this manner, the extension of the text created by them remains open-ended.

Fourth Phase

The subjects are asked for a title or a name for the story they just made.

Observation: All verbal contacts with the subjects are made from the ideas created in the listening process. The subjects are always encouraged to produce (give out) the more number of ideas they can create, being always free to use all the de ideas from the list while constructing the story.

Procedures for Analysis

To conduct the analysis it was imperative to elaborate three procedures, described below:

First procedure

We conducted a pilot study to experiment three versions of the initially designed procedures, aiming to get to a more adequate one or the one which could comprise the necessary elements for the analysis that we intended to do. This pilot project was conducted as "The construction of stories based on a list of words" and its aim was directed at observing the evolution of possibilities of the subjects, trying to get at the understanding of the different construction levels. That was done by analyzing the ways in that they might have applied themselves to get to a final product, the construction of the story. The techniques for such

analyses consisted of proposing a problem that involved a musical stimulus, requesting the construction of a list of ideas related to this stimulus, and finally, a request for an elaboration of a story.

Second procedure

After the pilot project, we conducted 200 interviews in Brazil. The data were collected in a musical situation to observe the Evolution of the Creative Thought. When first analyzing the data we were just observing what was occurring, assuming that whatever that was happening would be interlaced, interwoven in the psyche and would be a resultant of a system of equilibrations.

Later we made a description of the movements of the process and we made the cuts that these movements could admit (handle). We could see how the various observable action are interlaced and then we defined the points do to the cuts. The classifying criteria emerged a posteriori In summary, first we collected the data, then we determined the points with the important movement differences.

Third procedure

In a second phase, in the U.S., we utilized the same procedures that were described in the last procedure (we collect another 200 data) and we verified if the observed elements were isomorphous to the ones previously seem in the Brazilian samples. Accordingly, we obtained generalizable criteria which were independent of specific cultural interference. The criteria were detected, analyzed, and discussed.

Results

Given the information from the Pilot Project, a systematic collection of data in Brazil

followed in order to study the purposes of the present work. We can affirm that the data analyzed sustains the first obtained results of the pilot project and extended the observations that justified and explained the initial hypothesis.

After the elaboration of the criteria that provided for the observation of these three distinct levels, and its respective sublevels (first procedure for analyses), 200 new interviews were made in the U.S. (second procedure for analyses). We found with the protocols from the U.S. the same quantity of levels and sublevels already observed in the Brazilian sample.

In the study of the data we were attempted to understand what was occurring, to analyze how the links were occurring with the various observable (s), and further we made the description of movements and the cuts that these movements admit, based on the verbal logic observed by Piaget (1972), in accordance to his book El juicio y el razonamiento en el niño. We verified that the subjects presented general characteristics that make their actions possible or impossible in the solution of the proposed problems. These mechanisms, due to the different constructions concretely exposed to the experimenter, occasioned the realization of groupings, called since then Levels I, II, and III, that could be defined as initial, intermediate and/or of transitional, and final. The careful observation of these groupings led us to the understanding of what could be making possible or be impeding the creation of novelty by the subject; how and why the openings do occur and how the pseudo necessities obstruct, with the resistance of reality, the appearance of the openings of the schemes (Piaget, 1985). Based on the first observations, the levels were subdivided in A, B, and C that corresponded to the defining characteristics of its functioning.

We observed in this intercultural comparison of data that there were differences in the rate of development (velocity and/or individual rhythm), but it is very important to highlight that this

does not mean we have found differences in the order and/or sequence in the way which the development occurred. This order we have already learned from the literature, is invariable. The applicability and adequacy of criteria to study the three levels observed could be seen in the two cultures since the different subjects, independently of their own ages and/or origins, were represented in all the different levels sequence presenting, as epistemic individuals, a progression of their creative capacity that concretely demonstrated the existence of the Evolution of the Creative Thought.

Finally, obtained and confirmed the three different levels and its respective sublevels, we carried the selection of ten protocols with the objective to exemplify each sublevel and to provide the subsequent analysis and discussions. We selected for each sublevel, five Brazilian subjects, and five American subjects, totaling ninety protocols, from which fifty-four had their analysis presented in the scope of the work.

Following we will show one protocol for each observed sublevel and its deducted elements which all together characterize and evidenced the evolution of epistemological subject creative thought..

Examples of Protocols:

Levels observed and/or the evidence of the evolution of the creative thought:

Level I - Initial:

Sublevel I A: 1 - Utilize gestures when trying making sentences (elliptic language); 2 - Make sentences without any sense (egocentric, false equilibria, practices pseudo-assumptions when reasoning based on "internal models", precausality); 3 - Repeat models (syncretism, juxtaposition at any cost, transductive reasoning); 4 - Do not develop ideas (unrelated ideas that

follow one another); 5 - Do not connect ideas (juxtaposition, the subjects reason believing on their own premises); 6 - Do not give a title; or when they do the title is inadequate (syncretism, irreversible thinking, unconscious linking); 7 - Under the structural point of view, they show the possible being gradually engendered by the succession of ideas, the juxtaposition of ideas.

Cody - Age: 4 @

Ideas: (1) Dog, (2) basketball, (3) music, (4) TV, (5) EXIT, (6) air conditioner, (7) TV, (8) music.

Story: The (1)dog is mine. The (2)basketball. The (3)music sings .The (4)TV is there (gestures!). (5)EXIT (gestures!). (6)Air conditioner makes noise. The (7)TV again. The (8)music. The End!

Title: (Not given!)

Sublevel I B: 1 - The title is related to one and/or two ideas; it is sometimes inadequate (when adequate, the subjects extrapolate, it's an opening); 2 - Repeat models (syncretism, juxtaposition at any cost, transductive reasoning, it's opening);
3 - Start to develop each idea extensively, telling a story about each idea (the subjects extrapolate, it's an opening); 4 - Do not connect ideas (juxtaposition, reasoning believing on their own premises, it's conservation); 5 - Under the structural point of view, they show the possible being gradually engendered by the succession of ideas, and the juxtaposition of ideas.

Barbara - Age: 6

Idea: (1) A little elephant, (2) a little cat, (3) a little bird, (4) a little dog, (5) a ballerina, (6) a little toy, (7) a little chick, (8) a little panther, (9) a little cat, (10) duck, (11) a cow, (12) a little baby girl, (13) wood pecker, (14) a small ballerina dancing.

Story: Once upon a time (1)a little elephant was taking a walk and then he stumbled on a stone and fell in a hole. So then, he was going out. He tried to find a way out. But then, he saw a man and said: - Where do you want to go? Answered: - I want to go ... to get out of this hole. Then the man said: - Come here! Then, after, he went and got out and left to his little house. The cat (2)(a little cat) said like that: - Let's go for a walk! Meow! He understood! They went for a walk. Then, there was a stone. The little elephant said: - No! Watch out! You will fall on this stone! The little cat said: - No! I will not! I want to go to my little house. I am cold! And there he went. Once upon a time there was (3)a little bird who was in his own house sleeping. Then, a woman awake him up and he made meow! But then he felt scared because he was afraid. And went away. And he said like that: - Go to your little house. I am not frightening you! I am going to give little food! Then he stayed eating. He ran away and asked the little cat for a walk. Then he found little food, put it together and they ate together. Said like that: - Do you want to eat everything? No? Why not? The two ate and did not want more. Later they were hungry and went there and could not find more little food. Once upon a time a (4)little dog was taking a walk. He said like that: - Let's go play, little cat! But then, he said this: - No, I want to eat with you! I want to eat little food with you! Then the little cat said like that: - No! No! Let's go play! Don't be hungry! Soon your hunger will go away! Then he said like that: - Do you want to play? Let's go! Then the two went away and slept in their own little houses. Once upon a time (5)there was a ballerina who was dancing there. Then, a little friend of hers arrived and said: - Come! Come! Let's go play there on the courtyard! Then he said like that: - No! Let's go eating! I am hungry! He went home and ate. Said like that: - No, let's go play! Why? Are you hungry? - Yes, I am! The two went home. Then, she said like that: - Let's play, please! Then they went. And later they

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played. Once upon a time (6)a toy. The little girl was quarreling because of the toy. The little girl said like that: - Don't be afraid! They became friends. Once upon a time there were (7)a little chick. He said like that: - Do you want to play? The girl said like that: - No, I don't feel like doing it! Then she started to play, playing, playing. Then the little girls stays playing. So then, isn't it? They were back together again. So then, the other one felt asleep and went home and slept. Once upon a time a (8)little panther. She was fighting with the little cat. And the little cat said: - Meow! Meow! Then they became little friends. - No! Let's go play! They said like that: - Let's be friends! The (9)little cat remained talking with the other little cat her little friend. They remained playing, playing. Then they went home. Once upon a time a little duck (10)(duck). He went to the water and made a little friend. But then, his little friend went home and stayed there resting. And went to his little house, stayed there and never returned. Once upon a time there was a little cow (11)(a cow). She remained playing, playing, playing and got hurt and returned to her little house. And remained playing more there. So then, she laid and slept. Once upon a time, (12)a little baby girl. She hurt herself and then the little girl catch and took care of her. And then the little girl said like that: - You can stay there in my house? - Yes, you can, answered. Then they remained playing, playing, and went to their little house. Played more and more and the two slept. Once upon a time there was a (13)a wood pecker. He was cutting a tree. There was a little cat on. Little baby boy. Then they remained playing and did not remained sleeping further. Then, they said like that: - Hey! Let's go home to play there? - Let's go! Once upon a time there was a ballerina and she was dancing there (14)(a little ballerina dancing). So then, she said like that: - Let's go to the little house? - Let's go! Then she started to play. A little girl there, she was a beauty! She said: - Let's go play? - Let's go! Then a little baby girl felt down. Then a big older one helped her. Then

she carried her home and treated her with ointments. And healed!

Title: Dear Wood-pecker.

Sublevel I C: 1 -The title is related to one and/or two ideas (it's a conservation of previous schemes). Sometimes it's inadequate (when adequate, the subject extrapolates, and it's an opening); 2 - Sometimes repeat models, but already construct without utilizing models (start to put down barriers of syncretism, of juxtaposition at any cost); 3 - Utilize two ideas in the same sentence (the subjects extrapolate, make the text more concise, it's an opening); 4 - Utilize conjunction, pronouns and prepositions to link ideas (the subjects extrapolate); 5 - Do not link (interlace) the majority of ideas to construct the story (the subjects extrapolate, it's an opening); 6 - Under the structural point of view, show the possible being gradually engendered by the succession of ideas, the juxtaposition of ideas.

Caroline - Age: 8

Ideas: (1) President, (2) dancer, (3) party for 15 year's old, (4) forró, (5) classroom, (6) a male singer, (7) Chico Buarque.

Story: The important auctioneer shouted at the (1)President. The President fought with him. They hit each other. The two got hurt. My mother danced waltz when she was fifteen. It was very pretty. Danced with a friend. His name is Danilo. One day I have seen one (2)dancer. Pretty, elegant. I liked her very much. She gave me an autograph. I went to a (3)party of a 15 year old, very pretty, at my cousin Marco's house. I like to dance forró with my friend. His name is Danilo too. My teacher gives homework in the (5)classroom, on the chalkboard. I listened to a music of (6)a singer whose name is (7)Chico Buarque.

Title: The President

Level II - Intermediate:

Sublevel II A: 1 - The title is related to one or more ideas (the subjects extrapolate, it's an opening); 2 - Link ideas, creating a unity between them; interrupt this link at some point of the text (the subjects resist the juxtaposition, it's an opening); 3 - Utilize two or more ideas in the same sentence (it's an opening); 4 - Under the structural point of view, show the anticipation of various possibilities, exercising the concrete co-possibilities);

Paulo - Age: 8

Ideas: (1)Christmas, (2) party, (3) horse, (4) piano, (5) wire of copper, (6) lion, (7) microphone, (8) harness, (9) sword, (10) man, (11) film, (12) friend, (13)war, (14) boot, (15) fight, (16) television, (17) flowers, (18) grass, (19) food, (20) ring, (21) milk, (22) cow, (23) tiger, (24) tree, (25) panther.

Story: It was a pretty (1)Christmas night, with lots of presents. The Christmas was a beautiful (2)party and I was given, I and my fellow gained lots of presents and my sister got a ring. Me, my fellow, my mother, and my father rode a (3)horse. And we saw a man playing the (4)piano. After the trip, we saw a (5)wire of copper. We held it in our hands, put it on the window. After the wire of copper, we saw a (6)lion eating a sheep. My father killed the lion and we ran home. After Christmas we went out to buy a microphone. After the microphone, we bought a new (8)harness for me and for my fellow and my daddy and for my mom. And we found four (9)swords for me, for my dad and for my mom and my fellow. We went to the fight and our sword - it was so soft - broke. And we took it to the (10)man to fix. And the man showed the (11)film of the fight, how it was. The man's (12)friend gave us the film. And we went to the (13)war. We scratched our (14)boots. Later we sent our boots to be fixed again there by the man.

And we went there again for the (15)fight and we returned home. We watched (16)television. And my fellow and my dad, we caught three (17)flowers for my mother. My horse is eating there in the (18)grass. And my dad was eating (19)food at home. The (20)ring, we gave the ring to my sister and my sister put it on her hand. We took (21)milk from the (22)cow and we put together with the other cow. The (23)tiger eat the last cow that we bought. A banana (24)tree grew and my dad picked it up. Then my dad killed the (25)panther that ate his boot.

Title: The panther and my dad.

Sublevel II B: 1 - The title is almost adequate, related to the text (the subjects practice extensions); 2 - Link ideas, interrupting this linkage at some point of the text (the subjects conserve the schemes of the previous sublevel that consisted of an opening that happened before); 3 - Become attached to ideas that reappear in the development of other independent ideas (it's an opening, and it's a practice of previous schemes too); 4 - Under the structural point of view, show the anticipation of various possibilities, exercising the concrete co-possibilities);

Raquel - Age: 5.

Ideas: (1) Mother, (2) dance, (3) ballet, (4) man, (5) very beautiful clothes, (6) room, (7) mother seeing me, (8) teacher teaching, (9) a contest, (10) competing with three boys, (11) I won the contest, (12) my father and my mother were proud of me, (13) receiving flowers, (14) receiving a wonderful trophy, (15) was very happy, (16) my mother and my father gave me a present, (17) my father gave me a hug.

Story: My (1)mother was watching me (2) dance (3)ballet with a (4)man, in (5)very beautiful clothes, in a very beautiful (6) room. (7)Mother seeing me making a telephone call. (8)Teacher teaching ballet in a (9)contest, (10)contesting with three boys. (11) I won the contest.

(12) My father and my mother was proud of me. I received flowers from my mother (13)(receiving flowers). (14)Receiving a wonderful trophy in this contest. I (15)was very happy. (16)My mother and my father gave me a wonderful present. (17)My father gave me a hug with love.

Title: The ballet.

Sublevel II C: 1 - The title is almost adequate, related to the text (the subjects practice extensions); 2 - Link ideas, interrupting this linkage at some point of the text (the subjects conserve the schemes of the previous sublevel that consisted of an opening that happened before); 3 - The sentences are constructed to "accommodate" ideas (it's an opening, it's an extrapolation); 4 - Under the structural point of view, show the anticipation of various possibilities, exercising the concrete co-possibilities);

Carla - Age: 12

Ideas: (1) Ballerina, (2) dance at the theater, (3) Cristiane, (4) Lorena, (5) Leonardo, (6) party for 15 year's old, (7) Charles Chaplin, (8) sister, (9) my cousin Henrique.

Story: The (1)ballerinas like to dance. The way they interpret the dance, I think that they do it with much care. They work very hard to improve it and then they go to dance in a theater (2)(dance at the theater). One example is (3)Cristiane, because I have known her for a long time from a ballet class. (4)Lorena does not take classes, but she admires ballet. Every time I perform, she attends. (5)Leonardo, he likes ballet. He does not admire the ballerinas, but enjoy the music, because he likes classic music a lot. At my fifteen year old cousin's (6)party there was a waltz music similar to the music of the beginning and her biggest dream came truth. Right at the middle of the music I am listening to now, there is a fast music that reminds me Charles Chaplin. My

(8)sister have danced ballet for a year. And this year she decided to quit. (9)My cousin likes ballet and thinks it is beautiful too.

Title: The love for ballet.

Level III - Final:

Sublevel III A: 1 -The title is adequate, representing the global content developed (the subjects extrapolate, it's an opening); 2 - Develop each idea extensively, linking them, transforming them (it's and opening, it's extrapolation. The subjects practice a new model for this situation, although exercised in the sublevel I B context). 3 -They are not concise yet (practice a synthesis between the possible and the necessary); 4 - Under the structural point of view, the subject exerts abstract co-possibilities, where their practiced actualization in this level aren't nothing else than examples of "lots"of other conceivabilities);

Priscila - Age: 10

Ideas: (1) A woman playing, (2) a pleasant and beautiful sensation, (3)intelligent woman playing, (4) dance, (5) playing organ, (6) looking at a book, (7) sounds like a waltz, (8) reminds me of Christmas, (9) music for Little Red Riding Hood to pass, (10) should use pedals, (11) already went to the mall and already have studied in some school, (12) it is very competent with this organ and it is very intelligent.

Story: Once upon a time (1)a woman playing a music that brought up (2)a pleasant and beautiful sensation. In this story the woman needs to be pretty and intelligent (3)(intelligent woman playing). This (4)dance that she is playing could be very beautiful and loving. She could be very pretty and also could be a good player, because she plays very, very well. She must be very studious of this organ (5)(playing organ), because today to buy an organ could be very

difficult, because my father is trying to buy an organ for me. This woman, she must be (6)looking at the book because she must be studying or doing her best to have a life singing and playing the organ. She could have sang some waltz (7)(sounds like a waltz), like that one that we know. She could be a good singer with the organ and the teacher should have taught a waltz. This music for her should make her remember Christmas (8)(reminds Christmas) when she plays for her family. This music in the Riding Hood's time (9)(music for Little Red Riding Hood to pass), she must have remembered this music. And she had made all efforts she could to remember this music. She must have lots of strength to use the pedals (10)(should use pedals), because the pedals are not very reliable and need to use very good shoes to avoid hurting the feet. She could be, should have had some history book, she would not be able to imagine the music all by herself. We are not like fairies who do magic. She must have read something; like a book. She has already been at the mall to dance (11)(already went to the mall and has already studied in some school), because this music... she could have made a tape similar to the one I saw on television, playing like those people (12)(it is very competent with this organ and it is very intelligent). She must have lots of strength to be at the mall, in that hot weather.

Title: Woman good player.

Sublevel III B: 1 - The title is adequate and it represents the global content developed (the subjects conserve the schemes of the previous sublevel that consisted of an opening that happened before); 2 - Transform the idea initially given in order to adequate it better to the constructed content (it's conservation of schemes of a previous sublevel); 3 - Do not extend the ideas anymore. Start to construct with concisely (approximates to the synthesis between the possibility and the necessity. It's the extension of schemes of previous sublevels); 4 - Under the

structural point of view, the subjects exert abstract co-possibilities, where their practiced actualization in this level aren't nothing else than examples of "lots" of other conceivabilities);

Tammie - Age: 10 @

Ideas: (1) Old movie, (2) girls dancing, (3) boys dancing with girls, (4) horses galloping, (5) merry-go-round music, (6) people dancing in a ball, (7) rimes to lull, (8) work of Beethoven.

Story: Once there was an (1) old movie with (2)girls dancing. And then the boys arrived and danced with the girls (3)(boys dancing with girls). They were dancing the new dance called (4)"horses galloping". Then, they went to the city Merry-go-round (5)(merry-go-round music). When they were finished with the merry-go-round ride, they started to dance again (6)(people dancing in a ball). Then, they started to dance slow music like (7) rimes to lull. And then, Beethoven (8)(work of Beethoven) came and started to play one of his favorite works.

Title: All the different ways we could dance.

Sublevel III C: 1 - The title is adequate and represents the global content developed by the subject (keep schemes of the previous sublevels); 2 - Concise text (the subjects practice the synthesis. It's the synthesis between the possibility and the necessity, it's the extension of schemes of previous sublevels); 3 - Under the structural point of view, these subjects practices any co-possibility, the possibilities of "any...whatever" (which leads to the conception of phenomena given by chance. Practice creation to attend their external necessities to themselves, not only sticking to the pure mental experience.).

Agnaldo - Age: 7

Ideas: (1) elephant, (2) "*tucano*", (3) giraffe, (4) parrot, (5) woodpecker, (6) chicken, (7) bear.

Story: Once upon a time a very heavy (1)elephant that felt on a (2)"tucano". And a (3) giraffe saved the tucano. And the (4)parrot pecked the giraffe's head. And the (5)woodpecker called the (6)chicken to see the rooster on the giraffe's head. And the (7)bear got mad and ate all the animals.

Title: A bunch of animals.

The evidence of the Creative Thinking is a very good example of how the organization is inherent to the intellectual functioning and imposes structures to thoughts at the rate which the exercising of the thinking itself creates the most varied structures which sustain the integrated system that leads the subject to the knowing of the world. Here we can affirm once more that as Piaget used to say, the structures that make possible the knowledge are not innate, are not inscribed a priori in the subject's nervous system, and are not created by society by imposition of environment. They appear and evolve from the exchanges between the subject and other people, between them and the physical world in which they are developing. We observed in this experiment that between the subjects' nervous system and the experimenter there is the subjects' action, which shows concretely a sum of their experiences in the attempt to adapt themselves to the physical environment and to the social environment as well. The process of equilibration happens again in each level of development, showing that the subjects' individual activities provide the elucidation that while the subjects are knowing the world, they are concretely experiencing and exercising the Evolution of the Creative Though, as they trace the cycle of their own intellectual progression. The structures of though are richer in each other level, more complex and more inclusive. Nothing is lost. When the equilibrium is acquired, the tireless mental organism starts to explore other areas.

Finally, we have seem that, literally, the subjects create their thoughts, evidencing in successive and invariant levels, that the Evolution of the Creative Though is an action that the mind practices upon the reality that encloses it when they attempt to be prepared to know the world. In this effort, the subjects create their own capacity to think, create their intelligence. Each subject has his or her own rhythm. The intelligence grows inside the subject, is the capacity of change, the evolution, the passage from one level to the other, the construction of an integrated cycle that moves itself through openings, first through concrete possibilities, then through abstract co-possibilities, further through abstract possibilities of the type any...whatever, unlimited in number; surpassing barriers previously unsurmountable, triumphing pseudo necessities and/or pseudo impossibilities (Piaget, 1985). The subjects, in a concrete manner, in the exercise of the Evolution of their Creative Thought, create and conserve, conserve and create the thought. This could be an explication of how new things are created, the explication of how the spirit is engendered (Piaget, 1973).

Discussion

The results promote, for the first time in the literature, the facing of the questions posed by Piaget in his earliest and latest writings: What is the role of creation in development (Piaget, 1973) ? Is it because men are creative that they are able to know the world? And how can we find new things (Piaget, 1985; Bringuier, J.-C, 1978)? Better posing, how children open schemes, change and create structures while they are dealing with the knowledgeable world?.

Second, the results lead us to all the already known and discussed questions on the relationships between Development and Learning.

It is reasonable to affirm from our results that the children learn the mechanisms of

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thinking by practicing solving problems exogenously presented to them in order to know (make sense of) the surrounding world. To create outside themselves, to show a product of the activities they are inserted in or dealing with, they first create the novelty inside themselves, or better they practice the opening and extrapolation of schemes to product the novelty. Further and simultaneously, they progress with the enlargement of their structures and extrapolate while maintaining previous mechanism. This explains why they able to learn.

So to approach the first and second, learning is happening because the situation involved in its act is always a problem-solving situation, furthermore, it involves development because the subjects create and construct schemes and structures in order to find space in itself to promote the novelty that comes from the exogenous acquisitions. It explains why men are able to know the outside world, and knowing it they are finding new things while creating room inside themselves to know the outside world. The links between first and second are strong , once for men, learning is creating novelty inside as a mechanism to understand and exert novelty outside, which as a result, is to create overt products to be observed by their fellows. Being able to create novelty in their own mental organic world, they are also able and prepared to transform reality.

Moreover, there is a clear indication, from the results, that development concerns invention (invention of mental mechanisms of thinking) and not mere copying. The schemes and structures that are created by the subjects' activities toward solving the problem proposed (in this case, the writing of a text) were not a result of stimulus-response generalizations nor the practice of transformed responses, but they resulted from inventive construction which in a sense characterizes all living thought. What one child is able to exert at certain chronological point in time, the other child of the same age is not able to accomplish. Each child's construction is a

unique practice of his or her own creation of the mental mechanisms that this particular action involves in order to know the world and/or the proposed problem exogenously given.

In the interviews, the subjects did not know what was expected from them to be used as mechanism to write the story. The act of trying to do the task to solve the problem proposed led them toward construction of pathways to solve it. These pathways exposed by the subjects explicitly in their text, were results of a product of an epistemic subject, representing all subjects in their different levels of development. It evidenced the experimentation of openings of schemes, the maintenance of previous schemes, and the surpassing of impossibilities toward the construction of new structures.

So we observed that the thinking activity gives the children the opportunity to create thinking itself, in a sense, they are opening and practicing the openings of schemes, and the enlargement of structures, because everything created is maintained. The mental organism needs more mental space to learn the activity being held; that of thinking.

If we observe in detail the results, we see that the epistemic subjects first try hard to make sentences and use elliptic language as a schema to help their expression. Later they progress to a practice of repeating models, being sincretics and making juxtapositions of ideas at any cost. First, they start construction without utilization of models and show that they are putting down barriers. At last, they practice linking of ideas, and for them, this is opening to new schemes and a construction of new structures which will be maintained. And so on.

Others, at some level, give the title (which reflects their knowledge of the context in which they inserted their ideas) almost adequate to the ideas presented, relating them to the text. Gradually, they extrapolate and practice openings of their schemes when they start to give an

adequate title that represents the global context developed.

Other evidence of this evolution of creative thinking is the aspect of constructing elaborated ideas, or better, when they start to develop ideas. Initially, the epistemic subjects show unrelated ideas that follow one another. Later, they start to present development of each idea extensively, as if they are practicing a new scheme they just discovered as novelty that functions. Further, they start to utilize combination of different ideas, using two or more in the same sentence. This is an evidence of the equilibration mechanism that is internal self-regulated. The robustness of these results confirms our hypothesis which stated that it is possible to observe the opening of schemes and the construction of structures. Being that observable, we see that the subjects progress through successive equilibrations and cross from one level to the other immediately superior, showing conservation of anterior practices and cognitive mechanisms, and extrapolates to possible further ones.

Could it be that if we provide instructional opportunities for the subjects to practice this equilibration, given that they would be inserted in a problem solving situation, they would be exercising their cognitive mechanisms, and would lead them to learning or the exerting of faster development? Only future research on learning would provide the answers. Fortunately, our research can address the discussions on the aspect of development and learning, as conflict or congruence, discussed by Liben, L.S. (1987), and our results can get close to his questions, where he says that from the supportive base that leads from the opening of schemes to the exogenous acquisition of the world, the child practices learning. We observed that some children need more opportunities and time to practice their own way through it in a faster pace, others go trough it in slow motion. This explains why we see individual differences. Supporting

environments explain children learning, and the way they act upon these environment explains their development. The results we have and its implication for the educational setting are to be observed. Children with same chronological age, in the same classroom, are more likely to practice contents given based on different levels of construction of their knowledge, what promotes different levels of understanding of contents, and it evidences that they receive from exogenous situations different messages and/or they interpret them in different ways. What are they able to learn if we maintain invariable age, subject, methods of instruction, pace of instruction, and our believes that everything we teach is to be learned because of our efficiency? For sure, they will be learning different things and content quality, once each one, independent of their age, would be constructing their knowledge based on the way they create novelty, in the way they create, change and expand schemes, structures; based on how they progress in their path to construct their cognitive way to look and understand the world. As reminded us Liben (1987), for learning to be meaningful, it must take place in the context of understanding, of assimilation to the child's current cognitive structure. And if learning is viewed this way, we agree that even exogenously given (not self-discovered), all information must be viewed as dependent upon the knower.

Given the robustness of the results discussed, it may behoove cognitive researchers to pay closer attention to individual differences in the classroom.

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